

IN THE DRAWINGS:

The drawing figure has been amended to illustrate
resistor Rm.

REMARKS

The application has been amended and is believed to be in condition for allowance.

The drawing figure has been amended to illustrate resistor Rm.

Withdrawal of all formal objections/rejections is solicited.

The previously pending claims have been replaced with new claims taking into account the pending formal objections and supported by the original application as discussed below.

In the invention, a resultant field is defined as a magnetic field in the airgap resulting from an addition of first and second magnetic fields. The invention provides for the use of a sensor that is "sensitive only to the direction of the resultant field".

Thus, the invention provides a device for measuring the intensity of an electric current, of compensation type, which can be produced at low cost, but without compromising the accuracy of the supplied measurements. For example, the invention can be applied in a motor vehicle environment, see page 2, lines 29-36.

In particular, a Hall effect probe with bipolar output may be used. The prior art is not used in the prior art as the prior art requires devices which obtain both the direction and

the value of the magnetic field. None of the prior art devices teach or suggest a sensor sensitive only to the direction of the resultant field.

Reference is made to the drawing figure and the specification as originally filed for review of the invention as disclosed. The block B represents a current transformer with a core N and primary 1 and secondary 2 windings. The current i_1 is to be measured and a compensating current i_2 is shown.

A sensor 3 is placed in an airgap of the ferromagnetic core N and is sensitive to the direction of the magnetic field prevailing in the airgap. The magnetic field results from the addition of the opposing fields generated by the two windings wound on the ferromagnetic core.

The electrical power supply for the secondary winding 2 is provided by a +V direct current voltage source, through a conventional "H" configuration bridge of four transistors Q_1 to Q_4 . See "freewheeling" diodes D_1 to D_4 .

The closed loop mode regulation of the current flowing in the secondary winding 2 is handled by control means 5 of the bridge 4, as controlled by the output signal S of the sensor 3.

The sensor 3 may be a bipolar output Hall effect probe, which may take the form of an integrated circuit comprising in particular a linear Hall effect probe delivering a signal powering an input of a comparator, the output of the comparator controlling the conduction of a transistor. When the latter is

off (collector open), the voltage on the output pin 8 of the sensor is "pulled up" to +V by the resistor 9 connected between this pin and the +V source. When the transistor is on, this pin is grounded. The output signal S of the probe 3 is a "bipolar" square-wave signal alternating between the +V and 0 voltage levels.

When the output signal S is positive (+V level) the magnetic field prevailing in the airgap of the ferromagnetic core is oriented in a direction that is arbitrarily qualified as "positive". The control means 5 then keeps the transistors Q_1 and Q_3 turned on. A current i_2 flows in a circuit connected between the terminals 6 (then at the +V voltage) and 7 (then grounded). This circuit comprises the secondary winding 2 and, optionally, a CTN resistor 10. The current i_2 increases until the flux generated by the secondary winding 2 exceeds that generated by the primary winding 1, in which the current i_1 to be measured is flowing. When the direction of the resultant field in the airgap is reversed, the signal S switches to its low level (ground potential) resulting in the transistors Q_1 and Q_3 being turned off and the transistors Q_2 and Q_4 being turned on, the latter then applying a negative potential difference between the terminals 6 and 7. The result is a decrease in the current i_2 and a new increase in the field prevailing in the airgap.

Since the signal S is of pulse width modulation (PWM) type, the current i_2 oscillate about a mean value corresponding

to a zero flux of the magnetic field in this airgap. This oscillation is then self-maintaining.

I_2 can be obtained from a simple measurement of the voltage at the terminals of a measurement resistor R_m placed in series with the inductor 2, between the terminals 6 and 7. In this case, the resistance R represented in the figure of the drawing corresponds to the sum of this resistance R_m and the resistance of the inductor 2. If R_m is a resistor with low thermal drift, the sensor has no need for any temperature compensation, because the thermal drifts are compensated by the interlock function by varying the duty cycle.

Claims 1, 3, and 8 were rejected as anticipated by LENHARD 6,117,791.

Claims 2 and 9 were rejected as obvious over LENHARD in view of BERNA 5,734,264.

Claim 4 was rejected over LENHARD in view of GARY 4,639,665.

The new claims are believed to be both novel and non-obvious over the prior art, in particular over the applied art.

LENHARD does not teach or suggest the presently recited combination of features of the invention. Further, the other applied references would not teach or suggest modifications to LENHARD such that a modified LENHARD would anticipate or render obvious the present claims.

The applied references do not teach or suggest a combination including a sensor (3) positioned in an airgap of a core (N) of a transformer (B) and sensitive to a direction of a magnetic field prevailing in the airgap, the transformer, in use, having a first electric current (i_1) of a first magnetic field of a first direction generated by a primary winding (1) of the transformer, the transformer, in use, having the first electric current balanced by a second magnetic field of second direction opposite the first direction and generated by a secondary winding (2) of the transformer in which a second compensating current (i_2) flows, the magnetic field in the airgap being a field resulting from an addition of the first and second magnetic fields, the sensor (3) configured to regulate said compensating current (i_2) in closed loop mode by the sensor (3) sensing only a direction of said resultant field and controlling a reversal of a direction of circulation of the compensating current (i_2) in said secondary winding (2).

Nor do the references teach the combination recited by the other independent claims.

The dependent claims are believed allowable at least for depending from an allowable claim. However, applicants do not see that the features of the dependent claims are taught by the applied art.

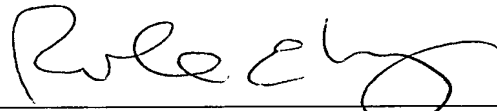
Accordingly, reconsideration and allowance of all the claims are respectfully requested.

Should there be any matters that need to be resolved in the present application, the Examiner is respectfully requested to contact the undersigned at the telephone number listed below.

The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17.

Respectfully submitted,

YOUNG & THOMPSON



Roland E. Long, Jr., Reg. No. 41,949
745 South 23rd Street
Arlington, VA 22202
Telephone (703) 521-2297
Telefax (703) 685-0573
(703) 979-4709

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